ISSN : 0974 - 7532 Volume 7 Issue 3

Trade Science Inc.

Research & Reviews in

BioSciences

Regular Paper

RRBS, 7(3), 2013 [93-97]

Use of radiation protection among Canadian urologists

Homan Miraliakbari[1]*, Michael W.Crichlow[2]

[1]Division of Urology, University of Alberta, (CANADA)

[2]Department of Surgery, University of Saskatchewan, (CANADA)

E-mail : homanmir62@hotmail.com; mwchrichlow@hotmail.com

ABSTRACT

Endourology procedures are common in urologic practice and urologic surgeons are subject to radiation exposure during these procedures via radiation scatter. Proper training on the use of fluoroscopy and radiation shields is of critical importance in lowering the health risks associated with cumulative radiation exposure. Participants were practicing urologists in Canada (n=446) who were contacted by e-mail to complete an anonymous survey regarding radiation protection use during fluoroscopic procedures. An on-line survey system, Zoomerang, was used to distribute and collect the results of the 15-question survey. The response rate was 20.2%. Of the 90 respondents, 74% had practiced urology for 10 years or more and 19% were fellowship trained. Although only 46% of respondents expressed concern about the potential health risks associated with radiation exposure, 81% and 100% of respondents regularly used radiation shielding thyroid collars and aprons during fluoroscopic procedures, respectively. Eighty-three percent of respondents reported never using radiation shielding eye protection, while 9% of respondents always practiced their use. However, 91% of respondents were interested in learning more about the potential harmful effects of radiation exposure to the eye. In conclusion, the majority of Canadian urologists employ radiation safety techniques during fluoroscopic procedures and wish to learn more about the potential health risks associated with its use. Greater training on the risks associated with radiation exposure during fluoroscopy and emphasis on safety training should be implemented by hospital occupational health and safety committees.

INTRODUCTION

The use of ionizing radiation for diagnostic and interventional purposes is common in urologic practice. There is an increased interest and awareness of the risks associated with the use of ionizing radiation among clinicians and patients. The majority of radiation exposure to urologists is related to the use of intraoperative fluoroscopy during endourological procedures, of which percutaneous lithotripsy procedures (PCNL) account for the largest amount of radiation exposure (TABLE 1)[1]. Long term exposure to ionizing radiation during interventional procedures is a concern because accumulation of exposure during a physician's career is a risk for development of skin erythema[2], cataracts[3] and possibly cancer[4]. Despite this risk, few urologists receive formalized training in the risks associated with ionizing radiation and the use of radiation protection. Radiation shielding aprons and thyroid collars contain between 0.25 and 0.5 mm of lead which reduces the cumulative absorption of radiation by 80% and 95%, respectively[5].

There are few studies on the risk of radiation exposure among urologists. The purpose of this study was to investigate the frequency of fluoroscopic procedures performed and the use of radiation protection among Canadian urologists.

Regular Paper

TABLE 1 : Average radiation dose in μGy per case, measured by thermoluminescent detection (TLD) (Adapted from Hellawell et al.)

	Surgeon		Assistant		Nurse	
	TLD	Calc	TLD	Calc	TLD	Calc
General ureteral procedures						
Eye (head)	1.9 ± 0.5	3.5	3.2 ± 0.8	2.4	0.8 ± 0.2	1.3
Hand	2.7 ± 0.7	10.0	2.1 ± 0.5	6.9	1.3 ± 0.3	2.5
Lower leg	11.6 ± 2.9	13.0	8.3 ± 2.1	9.0	0.8 ± 0.2	3.7
Foot	6.4 ± 1.6	13.0	5.7 ± 1.4	9.0	0.5 ± 0.1	3.7
PCNL procedures						
Eye (head)	40 ± 10	73	68 ± 17	51	16 ± 4[a]	27
Hand	48 ± 12	177	37 ± 9	123	24 ± 6[a]	44
Lower leg	167 ± 42	186	120 ± 30	130	11 ± 3[a]	57
Foot	93 ± 23	186	82 ± 21	130	8 ± 2[a]	57

METHODS

The respondents were practicing members of the Canadian Urological Association (CUA). A total of 446 urologists were invited to participate in the survey using e-mail invitations sent by the CUA email system. A comprehensive 15-question survey (Appendix A) was designed and accessed through an electronic link sent by e-mail which also contained a cover letter using Zoomerang, an on-line web site based survey system (www.zoomerang.com).

Appendix A

1. How long have you practiced Urology?
   - Less than 1 year
   - 1-3 years
   - 3-5 years
   - 5-10 years
   - >10 years
2. Have you completed an Endourology Fellowship?
   - Yes
   - No
   - Other Fellowship? Please specify.

   [ ]
3. How often do you use fluoroscopy?
   - Once per week or more
   - 2 to 3 times/month
   - Once/month
   - Less than once/month
   - Never used
4. How many percutaneous lithotripsy procedures do you perform?
   - Never
   - <5 per month
   - 5-10 per month
   - >10 per month
   - Other, please specify

   [ ]
5. How many ureteroscopic lithotripsy procedures do you perform?
   - <10 per month
   - 10-20 per month
   - 20-30 per month
   - >40 per month
6. Do you practice Urology primarily in an academic or community based centre?
   - Academic
   - Community based
7. If using fluoroscopy, do you wear a radiation shielding apron?
   - Yes
   - Sometimes
   - Never
8. If using fluoroscopy, do you wear a radiation shielding thyroid collar?
   - Yes
   - Sometimes
   - Never
9. If using fluoroscopy, do you wear radiation shielding eye protection?
   - Yes
   - Sometimes
   - Never
10. Are you aware of any potential risks of ionizing radiation exposure to the lens of the eye during fluoroscopy?

Yes
No

11. Are you concerned about the potential risk of radiation damage to the lenses of your eyes caused by fluoroscopy use?
    Definitely
    Probably
    Not sure
    Probably not
    Definitely not
12. Based on this survey, would you consider using radiation shielding eye protection?
    Definitely
    Probably
    Not sure
    Probably not
    Definitely not
13. Based on our survey, are you interested in finding out more about the effects of radiation exposure during fluoroscopy on the lens of the eye?
    Definitely
    Probably
    Not sure
    Probably not
    Definitely not
14. Related to the administration of our survey, how satisfied are you on a 1-5 scale where (1) means "Very Dissatisfied" and (5) is "Very Satisfied"? Select "N/A" if don't know or don't wish to respond.

1 Very Dissatisfied	2 Dissatisfied	3 Neither Satisfied nor Dissatisfied	4 Satisfied	5 Very Satisfied	N/A

15. Is there anything you would like to tell us about radiation protection during fluroscopy that was not already asked in the survey? Please type answer in space provided below.

An initial survey request was sent to all CUA members. The participants were informed that the survey was anonymous and voluntary. A small incentive was offered for participation (entry into a draw for a gift certificate), and there was no penalty for nonparticipation. The surveys were accessible from March 2nd to May 2nd, 2011. The responses were automatically entered into a database and tabulated by Zoomerang as frequencies and used for descriptive statistics. Chi-square analyses and Fisher's exact tests were used to perform group comparisons of the categorical outcomes. *t* tests were performed to compare continuous variables. A p value of <0.05 was considered significant for all tests. The data were analyzed using Statistical Analysis Systems, version 9 (SAS Institute, Cary, North Carolina).

RESULTS

Of the 446 urologists invited to participate, 90 (20.2%) completed the survey forms. Two responses were incomplete and were excluded from the study. Of the 90 completed responses, 80% used fluoroscopy at least once per week and 15% had completed an endourology fellowship. Fifty-five percent of respondents did not perform PCNL, 27% performed <5 PCNL per month, 6% performed 5-10 PCNL per month and 12% performed more than 10 PCNL per month. All participants performed ureteroscopic lithotripsy procedures.

Regarding radiation protection use, all respondents reported that they use radiation shielding aprons during fluoroscopic procedures, 81% use radiation shielding thyroid collars, and 9% use radiation shielding eyewear. Regarding radiation induced cataracts, 32% of respondents were unaware of the potential risk and 21% were unconcerned about the potential risk of radiation induced cataract development. Ninty-one percent of respondents were interested in learning more about the risk of radiation induced cataracts. Interestingly, participants who had completed an endourology fellowship were more likely to be aware of the risk of radiation induced cataract development ($p<0.05$) and were more likely to consistently wear radiation shielding eyewear ($p<0.001$).

DISCUSSION

The results of our survey reveal that Canadian urologists commonly use radiation shielding aprons and thyroid collars. However, the use of radiation shielding eyewear is uncommon among respondents. The majority of respondents were interested in learning more about radiation induced cataract development.

Posterior and subcapsular opacities in the lens have been a consistent finding among those with high cumulative exposure to ionizing radiation[6]. However, hu-

Regular Paper

man studies on cataract development secondary to diagnostic radiologic procedures have been less consistent[3]. This is likely due to difficulty accounting for confounding variables that also lead to cataract development such as age, gender, family history, smoking history, race/ethnicity, diabetes and other medical conditions, environmental factors and overexposure to sunlight[7].

Chodick et al. performed a 20 year prospective cohort study showing the cumulative risk of cataract development among radiologic technologists in the United States[8]. This study showed a positive correlation between the cumulative radiation exposure and relative risk of developing cataracts (Figure 1). For radiologic technologists in the highest lifetime occupational radiation exposure category (mean, 60 mGy) versus lowest category (mean, 5 mGy), the adjusted hazard ratio of cataract development was

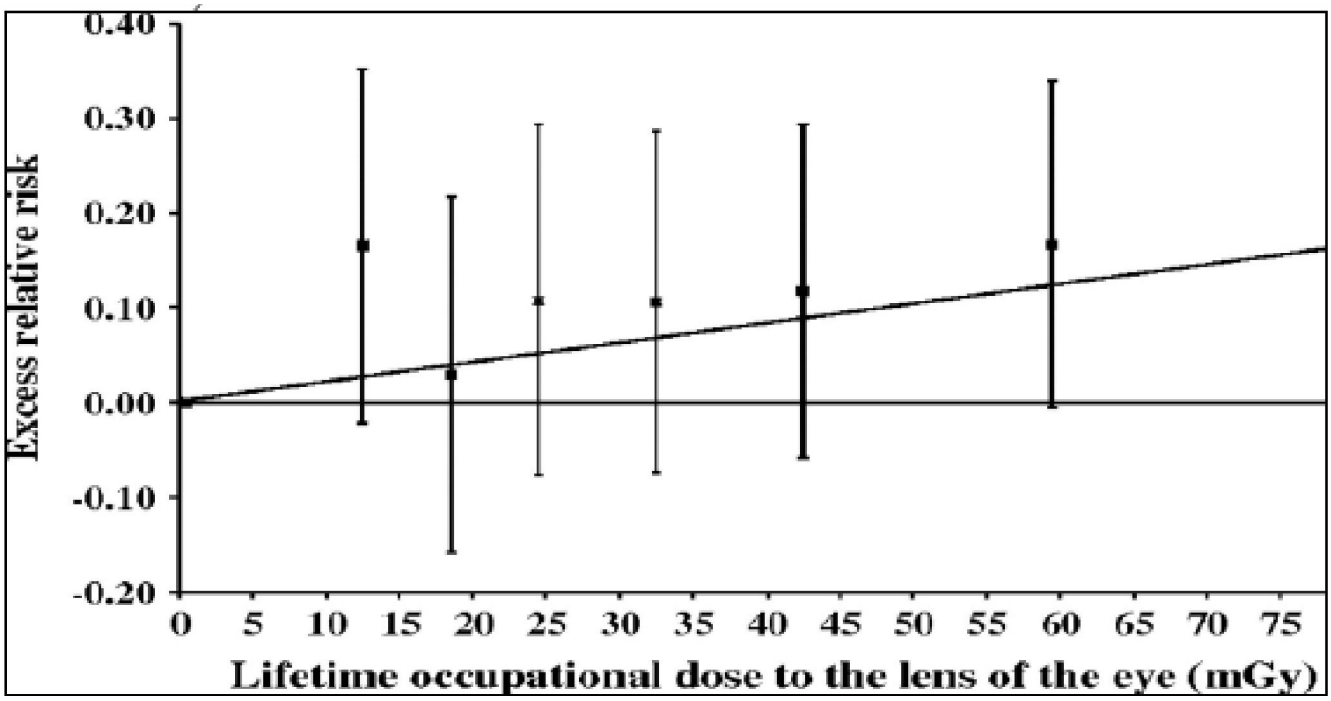

Figure 1 : Risk of cataract development after occupational exposure to ionizing radiation (adapted from Chodick et al.)

1.18.

Previous reports have highlighted the importance of radiation protection during PCNL[9]. Hellawell et al. studied the amount of radiation exposure to urologists during ureteroscopic procedures and PCNL using thermoluminescent radiation detectors[1]. This group showed that during ureteroscpoic procedures, the urologist's eye is exposed to an average of 1.9 micrograys (μGy) of radiation, compared to an average of 40 μGy during PCNL procedures (TABLE 1). Extrapolating on the fluoroscopic screening data of Hellawell et al., we can calculate the annual radiation exposure and risk of cataract development of the respondents in our survey (appendix B). Assuming 10 - 20 ureteroscopic procedures per month, the annual occupational radiation exposure to the lens of the eye would be 0. 25 - 0.5 mGy. The lifetime occupational radiation exposure to the lens of the eye in this group would be 6.25 - 12.5 mGy. Using similar assumptions, the lifetime occupational radiation exposure to the lens of the eye for urologists performing 5 – 10 PCNL per month would be 60 – 120 mGy. This amount radiation exposure to the lens of the eye is in excess of highest exposure group in the study by Hellawell et al. and illustrates the potential risk of cataract development and other radiation injuries in urologists performing PCNL procedures. These findings emphasise the importance of wearing radiation shielding aprons, thyroid collars and eyewear during these procedures.

Appendix B

Calculations for life time radiation exposure to the lens of the eye

1. 20 Ureteroscopic procedures per month-
   20 ureteroscopies per mo X 12 mo per yr X 1.9

μGy per case (from TABLE 1) = 456 μGy = 0.5 mGy per yr Now assuming 25 years of exposure = 12.5 mGy life time radiation exposure to the eye lens

2. 10 PCNL per month-
   10 PCNL per mo X 12 mo per yr X 40 μGy per case (from TABLE 1) = 4800 μGy = 4.8 mGy per yr
   Now assuming 25 years of exposure = 120 mGy life time radiation exposure to the eye lens

The International Commission on Radiological Protection have published recommendations on avoidance of radiation injuries from medical interventional procedures to patients and medical personnel[10]. Recommendations to reduce radiation exposure to the surgeon and operating room personnel include using fluoroscopy units with the x-ray generator located underneath the operating table and the x-ray detector located above the table. This is referred to as the "undercouch" position of xray generator. Other recommendations include use of tableside radiation shields, increasing the distance of operator from xray source, use of the low-dose radiation mode and pulsed low dose radiation mode, and to collimate the x-ray beam tightly to the area of interest. These suggestions help reduce radiation injuries by reducing radiation scatter exposure to radiosensitive regions of the surgeon and operating room personnel.

Limitations of our study are related to the potential biases of a survey based study. These include misinterpretation of the questions by respondents, leading to inaccurate responses to our questions. The response rate for our survey was 20.2%, thus we are using the responses of a subset of our population and making generalized assumptions for our entire population. Self-selection bias is an inherent risk in all survey based studies, and ours is no exception. A final limitation of our study is the inability to quantify the actual amount of radiation exposure in respondents.

Our study is the first investigating fluoroscopy use among Canadian urologists and the use of radiation protection among this group. This study highlights the potential risk for the development of radiation induced cataracts among urologists, particularly those that perform more than 5 PCNL per month, and the importance of radiation protection use.

REFERENCES

[1] G.O.Hellawell, S.J.Mutch, G.Thevendran, E.Wells, R.J.Morgan; Radiation exposure and the urologist: what are the risks?, J.Urol., **174**, 948-52 **(2005)**.

[2] T.R.Koenig, D.Wolff, F.A.Mettler, L.K.Wagner; Skin injuries from fluoroscopically guided procedures, Am.J.Roentgenol, **177**, 3-20 **(2001)**.

[3] F.Mettler, T.R.Koenig, L.K.Wagner, C.A.Kelsey; Radiation injuries after fluoroscopic procedures, Seminars Ultrasound, CT., MRI., **23**, 428-42 **(2002)**.

[4] S.Yoshinaga, K.Mabuchi, A.J.Sigurdson, M.M.Doody; Ron E. Cancer risks among radiologists and radiologic technologists: review of epidemiologic studies, Radiology, **233**, 313-21 **(2004)**.

[5] Radiation and your patient: a guide for medical practitioners, Annals of the ICRP, **31**, 5-31 **(2000)**.

[6] N.A.Brown, G.A.Shun-Shin, P.Lewis, W.A,Cramp, C.Arlett, J.Cole, et al; Relationship of cataract to radiation sensitivity, Br.J.Ophthalmol., **73**, 955-959 **(1989)**.

[7] B.E.Klein, R.Klein, K.E.Lee, Diabetes, cardiovascular disease; selected cardiovascular disease risk factors, and the 5-year incidence of age-related cataract and progression of lens opacities: the Beaver Dam Eye Study, Am.J.Ophthalmol., **126**, 782-790 **(1998)**.

[8] G.Chodick, N.Bekiroglu, M.Hauptmann, B.H.Alexander, M.Freedman, M.M.Doody, et al; Risk of cataract after exposure to low doses of ionizing radiation: a 20-year prospective cohort study among US radiologic technologists, Am.J. Epidemiol., **168**, 620-31 **(2008)**.

[9] P.Kumar; Radiation safety issues in fluoroscopy during percutaneous nephrolithotomy, Urol.J., **5**, 15-23 **(2008)**.

[10] International Commission on Radiological Protection, Avoidance of radiation injuries from medical interventional procedures, ICRP Publication, Pergamon, 85 **(2000)**.